

## The Case of Industrial Melanism

During the period when the number of coal-burning factories in England was increasing (during the so-called Industrial Revolution) it was noticed that the number of melanic individuals of the species of Peppered Moth (*Biston betularia*) was becoming more common. Originally rare in the population of normally light-colored moths, the frequency of the melanic form increased in polluted areas until it was over 90%. This change in color has come to be known as “industrial melanism.”

The change was presumed to be a result of natural selection since the melanic moths in polluted areas better matched the blackened tree trunks where they rested during the day. In unpolluted forests distant from industrial centers the tree trunks were not blackened and the lighter colored moths were present in higher frequencies.

We know that the difference between the two forms of moth is controlled by a pair of alleles at a single chromosome locus.

- Q: Can the changes in gene frequencies (as seen in the changes in frequencies of light and dark moths) be considered evidence of natural selection?
- Q: Is there another possible explanation?
- Q: Can you think of a experiment to test the hypothesis that being light or dark makes a difference in the survival rates of Peppered Moths?

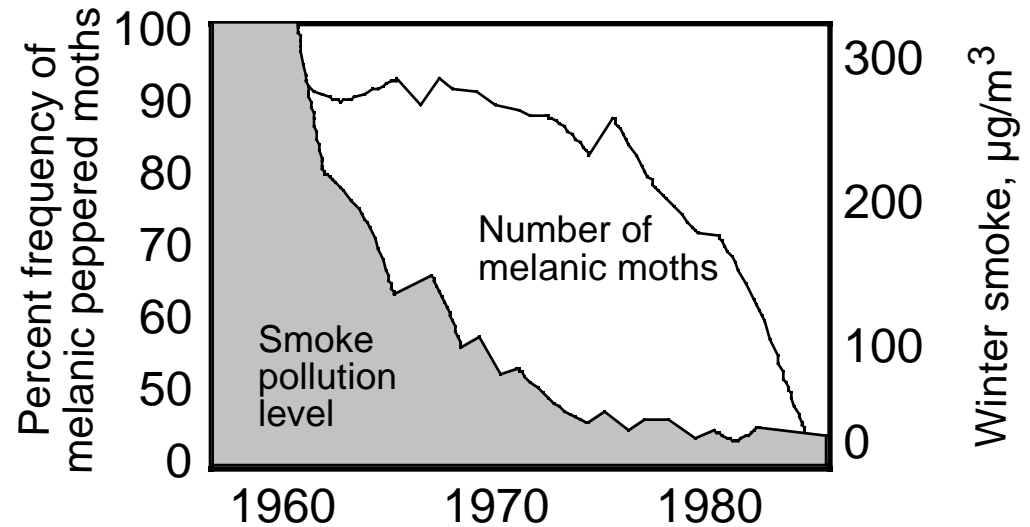
A physician and lepidopterist named Kettlewell released a large number of melanic moths and an equal number of light moths into a polluted forest one night. The following night he used lights to attract and capture moths. Later he repeated the release and recapture of moths of both types into unpolluted woods.

- Q: If the hypothesis of natural selection favoring the melanic moths is correct, what do you predict would be the results of the recapture efforts in the polluted area? And in the unpolluted area?

Here are the results of Kettlewell's Experiment.

Recaptured from unpolluted area:	Recaptured from polluted area:
14.6% Light Morph 4.7% Dark Morph	13.0% Light Morph 27.5% Dark Morph

In the 1960's after legislation to control the emissions of coal smoke, the level of pollution in English forests declined. The following graph represents the changes in smoke levels and the moth populations.



- Q: Do the data support the hypothesis that natural selection is operating here?
- Q: Which phenotype appeared to be favored? Why do you think so?
- Kettlewell was not satisfied that his conclusions were correct just because the moths he expected to be disadvantaged were recaptured in smaller numbers. He thought that predators were finding it easier to prey on the moths that did not match their backgrounds, but he did not know that this was so.
- Q: How could you verify that the color match between moth and substrate was actually making a difference in how predators affected the moth population?
- Kettlewell placed moths on tree trunks in daylight, observed and filmed the results from a place of concealment a short distance away.
- Q: What do you expect were his observations?
- Q: Why did he conceal himself?
- Q: Among the tools of science are historical studies, correlation studies and experimentation. Comment on the use, usefulness, validity and limitation of each tool as applied to the case of Industrial Melanism. (Please submit written answer to this question by Monday next.)